

means for cooling said second coil wire, which is disposed at the periphery of said outer coil;

wherein a diameter of said second coil wire is smaller than that of said first coil wire.

REMARKS

Favorable consideration of this application as presently amended and in light of the following discussion is respectfully requested.

Claims 1-4 are pending in the application with Claims 1 and 4 having been amended by way of the present amendment.

In the outstanding Office Action dated December 19, 2002, Claims 1-4 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Nakanishi (JP5447016) in view of Rabe (U.S. Patent No. 4,296,344).

Independent Claims 1 and 4 are amended to recite that the iron core has 'a center and a plurality of open-ended teeth extending radially from the center to form a plurality of slots between the open-ended teeth, each slot configured for coil winding.' Support for this amendment is found in Applicants' originally filed specification.¹ No new matter is added.

Briefly recapitulating, amended Claim 1 is directed to a commutator motor comprising an iron core 13 having a center 17 and a plurality of open-ended teeth 21. The open-ended teeth extend radially from the center and form a plurality of slots between the open-ended teeth. Each slot 19 is configured for coil winding. The motor also includes a rotation shaft inserted in a center 17 of the iron core 13; a pair of first and second commutators mounted on the rotation shaft at opposite ends of the iron core; a first coil wire connected to the first commutator, and wound on bottoms of the slots of the iron core to

¹ Figures 2-4.

provide an inner coil; a second coil wire connected to the second commutator, and wound on the inner coil in the slots of the iron core to provide an outer coil at a side of the opened outer radial end of the slot; a first terminal that can be connected to a first power source to supply electric power of the first power source to the first coil wire through the first commutator; and a second terminal that can be connected to a second power source to supply electric power of the second power source to the second coil wire through the second commutator; wherein a diameter of the second coil wire is smaller than that of the first coil wire. Independent Claim 4 is directed to a commutator motor that includes means for cooling said second coil wire, which is disposed at the periphery of said outer coil.

In dual-wound commutator motors, the temperature of the second winding of thin coil wire rises quickly.² By using radially-extended open-ended teeth it is possible for the second winding to be positioned at the side of the opened outer radial end. Thus, heat generated from the second winding can readily diffuse away from the coils and the core which improves the reliability and safety of the commutator motor. Radially-extended open-ended teeth also allows for the use of a cooling device disposed at the periphery of the second winding, so as to forcibly cool the second wiring and further improve the reliability and safety of the commutator motor.³ Radially-extended open-ended teeth also allow for easier winding of complex winding patterns as shown in Applicants' Figures 2-3.

Nakanishi discloses a multi-commutator machine comprising a pair of iron cores with a first coil wound on the inner portion of the first core and the outer portion of the second core. Nakanishi also discloses a second coil wound on the inner portion of the second core and the outer portion of the first coil. With this criss-cross of first and second coils on first

² Specification, page 2, lines 10-20.

³ Specification, page 3, line 19 – page 4, line 4.

and second cores, electrical equilibrium is maintained.⁴ Nakanishi does not disclose 'a center and a plurality of open-ended teeth extending radially from the center to form a plurality of slots between the open-ended teeth, each slot configured for coil winding' as recited in Applicants' amended independent Claims 1 and 4. Thus, Applicants respectfully submit that Nakanishi does not anticipate or render obvious the invention recited in Applicants' Claims 1-4.

Rabe discloses wound stators 11 and stator assemblies 12 for multi-speed or pole changing motors. The stator core 11 of Rabe is provided with an axially extending bore 15 for accepting a rotor along with a plurality of axially extending core slots 19.⁵ However, like Nakanishi, Rabe does not disclose 'a center and a plurality of open-ended teeth extending radially from the center to form a plurality of slots between the open-ended teeth, each slot configured for coil winding' as recited in Applicants' amended independent Claims 1 and 4. In fact, the teeth of Rabe are close-ended, not open-ended.⁶ These close-ended teeth extend inward and form a closed space that traps heat from the second winding. Furthermore, the close-ended teeth of Rabe do not allow for easy winding of complex winding patterns as is possible with the open-ended teeth of the present invention. Thus, Applicants respectfully submit that Rabe does not anticipate or render obvious the invention recited in Applicants' Claims 1-4.

Therefore, as none of the cited prior art, individually or in combination, disclose or suggest all the elements of independent Claims 1 and 4, Applicants submit the inventions defined by Claims 1 and 4, and all claims depending therefrom, are not rendered obvious by

⁴ Nakanishi, page 1, lines 13-28 of English translation of abstract and Figure 2.

⁵ Rabe, column 3, lines 47-60.

⁶ Rabe, Figure 8.

the asserted prior art for at least the reasons stated above.⁷ Furthermore, Applicants submit there is no teaching, suggestion, or motivation, either explicitly or implicitly, in either reference to combine or modify the teachings of Nakanishi and Rabe to arrive at Applicants' inventions recited in Claims 1 and 4. Neither reference discloses any concerns or accommodation for cooling. Nakanishi is directed to improved electrical equilibrium while Rabe is directed to motor efficiency. Thus, Applicants submit it is only through an impermissible hindsight reconstruction of Applicants' invention that Claims 1 and 4 can be considered to be rendered obvious by the cited references.⁸

Accordingly, in view of the present amendment and in light of the previous discussion, it is respectfully submitted that the application is believed in condition for allowance and early and favorable action to that effect is respectfully requested.

⁷ MPEP § 2142 "...the prior art reference (or references when combined) must teach or suggest **all** the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosure. In re Vaeck, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991)."

⁸ MPEP § 2143.01 "Obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either explicitly or implicitly in the references themselves or in the knowledge of one of ordinary skill in the art."

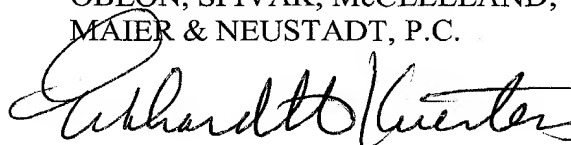
Finally, the attention of the Patent Office is directed to the change of address of
Applicants' representative, effective January 6, 2003:

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IN THE CLAIMS

Please amend Claims 1 and 4 as follows:

1. (Amended) A commutator motor comprising:

an iron core having a center and a plurality of open-ended teeth extending radially from the center to form a plurality of slots between the open-ended teeth, each slot configured for coil winding;

a rotation shaft inserted in a center of said iron core

a pair of first and second commutators mounted on said rotation shaft at opposite ends of said iron core;

a first coil wire connected to the first commutator, and wound on bottoms of the slots of said iron core to provide an inner coil;

a second coil wire connected to the second commutator, and wound on said inner coil in the slots of said iron core to provide an outer coil at a side of the opened outer radial end of the slot;

a first terminal that can be connected to a first power source to supply electric power of said first power source to said first coil wire through said first commutator; and

a second terminal that can be connected to a second power source to supply electric power of said second power source to said second coil wire through said second commutator;

wherein a diameter of said second coil wire is smaller than that of said first coil wire.

4. (Amended) A commutator motor comprising:

an iron core having a center and a plurality of open-ended teeth extending radially from the center to form a plurality of slots between the open-ended teeth, each slot configured for coil winding;

a rotation shaft inserted in the center of said iron core

a pair of first and second commutators mounted on said rotation shaft at opposite ends of said iron core;

a first coil wire connected to the first commutator, and wound on bottoms of the slots of said iron core to provide an inner coil;

a second coil wire connected to the second commutator, and wound on said inner coil in the slots of said iron core to provide an outer coil;

a first terminal that can be connected to a first power source to supply electric power of said first power source to said first coil wire through said first commutator;

a second terminal that can be connected to a second power source to supply electric power of said second power source to said second coil wire through said second commutator;
and

means for cooling said second coil wire, which is disposed at the periphery of said outer coil;

wherein a diameter of said second coil wire is smaller than that of said first coil wire.